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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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EXAMINER

FAREKH, N

ART UNIT	PAPER NUMBER
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2811

DATE MAILED: 07/18/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.

09/462,796

Applicant(s)

Watanabe et al

Examiner

Nitin Parekh

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on Jun 8, 2001
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 35 C.D. 11; 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-33 is/are pending in the application.
- 4a) Of the above, claim(s) 1, 2, 6, 8, 9, 12, 13, 16, 17, 20, 22, 26, 27, 30, and 31 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 3-5, 7, 10, 11, 14, 15, 18, 19, 21, 23-25, 28, 29, 32, and 33 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claims _____ are subject to restriction and/or election requirements.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are objected to by the Examiner.
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

- 13) ☒ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).
- a) ☒ All b) ☐ Some* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- *See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

- 15) ☒ Notice of References Cited (PTO-892)
- 16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 17) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s). 1
- 18) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 19) ☐ Notice of Informal Patent Application (PTO-152)
- 20) ☐ Other: _____

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DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 3 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tago et al (US Pat. 5508561) in view of Hosomi et al (US Pat. 6049130) and prior art (IDS-paper #1; Japanese Pat. 08191072).

Regarding claim 3, Tago et al disclose a semiconductor device (Fig. 14B; Col. 9, line 40- Col. 10, line 32) having a plurality of truncated cone shaped bump electrodes (6a/4a/4b; Col. 7, line 19- Col. 7, line 63) bonded by thermal compression (Col. 7, line 35) onto pad electrodes (2 in Fig. 14B) arranged on the semiconductor chip (1 in Fig. 14B). Tago et al fail to specify the bumps being in the shape of a pyramid. However, Fig. 14B in Tago et al's device shows the bumps resembling a shape of a truncated cone or pyramid with a curved dome/tip. Hosomi et al teach using pyramid shaped bumps using conventional thermal compression (6/7 in Fig. 20; Col.

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1, line 45- Col. 2, line 68). The prior art reference (IDS-paper #1; Japanese Pat. 08191072; Fig. 2; Col. 1-3) show a variety of shapes including triangular/conical/square shaped pyramidal bumps bonded onto pad electrodes. Therefore, it would have been obvious to a person of ordinary skill in the art at the time invention was made to choose pyramidal shaped bump electrodes to achieve the desired bonding strength using Hosomi et al's and prior art bump shape in Tago et al's device.

Regarding claim 7, Tago et al further disclose the bump electrodes being made of a material selected from a group consisting copper (Cu), Nickel (Ni), gold (Au), etc. (Col. 9, line 40).

3. Claims 4 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tago et al (US Pat. 5508561) in view of Hosomi et al (US Pat. 6049130) and prior art (IDS-paper #1; Japanese Pat. 08191072).

Regarding claim 4, as explained above for claim 3, Tago et al disclose using the bump electrodes of metals such as Ni, Au, etc. and bonding them onto pad electrodes by conventional thermal compression but Tago et al fail to specify that an alloy can be formed at their junctions by using conventional heating and compression processes. Hosomi et al teach using the cone/pyramid shaped bumps using conventional thermal compression where a layer comprising an alloy such as Au/Sn (9/8 in Fig. 20; Col. 1, line 45- Col. 2, line 68) is formed at the junction due to

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intermetallic diffusion. Therefore, it would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate pyramidal shaped bump electrodes and pad electrodes which can form an alloy at the junctions to achieve the desired bonding strength using Hosomi et al and prior art structure in Tago et al's device.

Claim 23 is rejected as explained above for claims 4, 3 and 7.

4. Claims 5 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tago et al (US Pat. 5508561) in view of in view of Hosomi et al (US Pat. 6049130) and prior art (IDS-paper #1; Japanese Pat. 08191072) and further in view of Chigawa et al (US Pat. 6172422).

Regarding claim 5, as explained above for claim 3, Tago et al in view of Hosomi et al and prior art disclose using the pyramidal/conical bump electrodes bonded onto pad electrodes but fail to specify bonding them onto rewired metal conduction pads electrically connected to pad electrodes arranged on a semiconductor chip. Chigawa et al teach bonding pyramidal/conical bump electrodes onto rewired conductive/metal substrate pad (6a/6 in Fig. 32A-34C; Col. 14, line 44; Fig. 38) which are electrically connected to pad electrodes arranged on a semiconductor chip. The cited reference by Owada et al teach using conventional rewired metal/connection pads (42 in Fig. 6; Col. 7) on the substrate (41 in Fig. 6) for a flipchip bonding. Therefore, it would have been obvious to a person of ordinary skill in the art at the time invention was made to

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incorporate the pyramidal bump electrodes bonded onto rewired metal conduction pads electrically connected to pad electrodes arranged on a semiconductor chip to achieve increased interconnection capability using Chigawa et al's wiring design in Tago et al's device in view of Hosomi et al and prior art.

Claim 24 is rejected as explained above for claims 5, 3 and 7.

5. Claims 10 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tago et al (US Pat. 5508561) in view of Hosomi et al (US Pat. 6049130) and prior art (IDS-paper #1; Japanese Pat. 08191072).

Regarding claim 10, Tago et al disclose a mounting structure comprising:

- a semiconductor device (Fig. 14B; Col. 9, line 40- Col. 10, line 32) having a plurality of truncated cone shaped bump electrodes (6a/4a/4b; Col. 7, line 19- Col. 7, line 63) bonded by thermal compression (Col. 7, line 35) onto pad electrodes (2 in Fig. 14B) arranged on the semiconductor chip (1 in Fig. 14B), and
- the mounting structure enabling the semiconductor device to be mounted on a substrate (5 in Fig. 14B) by bonding the bump electrodes onto the terminals (26 in Fig. 14B) formed on the substrate

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As explained above for claim 3, Tago et al fail to specify the bumps being in the shape of a pyramid. However, Fig. 14B in Tago et al's structure shows the bumps resembling a shape of a truncated cone or pyramid with a curved dome/tip. Hosomi et al teach using pyramid shaped bumps using conventional thermal compression (6/7 in Fig. 20; Col. 1, line 45- Col. 2, line 68). The prior art reference (IDS-paper #1; Japanese Pat. 08191072; Fig. 2; Col. 1-3) show a variety of shapes including triangular/conical/square shaped pyramidal bumps bonded onto pad electrodes. Therefore, it would have been obvious to a person of ordinary skill in the art at the time invention was made to choose pyramidal shaped bump electrodes to achieve the desired bonding strength in Tago et al's structure in view of Hosomi et al and prior art.

Claim 21 is rejected as explained above for claims 10, 3 and 7.

6. Claims 11 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tago et al (US Pat. 5508561) in view of Hosomi et al (US Pat. 6049130) and prior art (IDS-paper #1; Japanese Pat. 08191072).

The combined teachings of Tago et al, Hosomi et al and prior art apply to claims 11 and 25 as explained above for claims 10, 4 and 11, 4 and 7 respectively.

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7. Claims 14 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tago et al (US Pat. 5508561) in view of Hosomi et al (US Pat. 6049130) and prior art (IDS-paper #1; Japanese Pat. 08191072).

Regarding claim 14, as explained above for claim 10, Tago et al further disclose processes such as soldering (Col. 10, line 27) or using an adhesive/conductive resin (Col. 10, line 24) to bond the pyramidal/conical bump electrodes to the terminals formed on the substrate.

Claim 28 is rejected as explained above for claims 14 and 7.

8. Claims 15 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tago et al (US Pat. 5508561) in view of Hosomi et al (US Pat. 6049130) and prior art (IDS-paper #1; Japanese Pat. 08191072).

The combined teachings of Tago et al, Hosomi et al and prior art apply to claims 15 and 29 as explained above for claims 14, 4 and 15, 4 and 7 respectively.

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9. Claims 18 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tago et al (US Pat. 5508561) in view of Hosomi et al (US Pat. 6049130) and prior art (IDS-paper #1; Japanese Pat. 08191072).

The combined teachings of Tago et al, Hosomi et al and prior art apply to claims 18 and 32 as explained above for claims 14 and 28 respectively.

10. Claims 19 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tago et al (US Pat. 5508561) in view of Hosomi et al (US Pat. 6049130) and prior art (IDS-paper #1; Japanese Pat. 08191072).

The combined teachings of Tago et al, Hosomi et al and prior art apply to claims 19 and 33 as explained above for claims 15 and 29 respectively.

Papers related to this application may be submitted directly to Art Unit 2811 by facsimile transmission. Papers should be faxed to Art Unit via Technology Center 2800 fax center located in Crystal Plaza 4, room 4C23. The faxing of such papers must conform with the notice published in the Official Gazette, 1096 OG 30 (15 November 1989).

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nitin Parekh whose telephone number in (703) 305-3410. The examiner can be normally reached on Monday-Friday from 08:30 am-5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas, can be reached on (703) 308-2772. The fax number for the organization where this application or proceeding is assigned is (703) 308-7722 or 7724.

Nitin Parekh

07-12-01


TOM THOMAS
SUPERVISORY PATENT EXAMINER